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Hydrazine Mononitrate in Hydrazine, Supplemental Physical Data

2 suppl

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John B. Krasinsky

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CONTENTS

I. Introduction 1

II. Preparation of Solution and Techniques Used to Obtain Data . . 2

III. Conclusion 2

Table 1. Composition of prepared solution 2

FIGURES

1. Freezing point apparatus 3
2. Density vs. temperature 4
3. Logarithm of vapor pressure vs. reciprocal of absolute temperature . . 5
4. Kinematic viscosity vs. temperature, °F 6
5. Density vs. temperature, anhydrous solutions 7
6. Density vs. temperature, solutions containing 1% water 8
7. Logarithm of vapor pressure vs. reciprocal of absolute temperature, anhydrous solutions 9
8. Logarithm of vapor pressure vs. reciprocal of absolute temperature, solutions containing 1% water 10
9. Kinematic viscosity vs. temperature, °F, anhydrous solutions 11
10. Kinematic viscosity vs. temperature, °F, solutions containing 1% water 12

ABSTRACT

21071

The density, vapor pressure, viscosity, and freezing point are reported for a solution of hydrazine mononitrate dissolved in hydrazine with approximately 1% of added water.

I. INTRODUCTION

The data included in this Report (for a concentration of solution not previously reported) supplement that of Technical Memorandum No. 33-103.[1]

Additional data for a solution containing approximately 1% water, 24% hydrazine mononitrate, and 75% hydrazine were required because of the continued interest in this mixture as a possible rocket fuel.

[1] Vango, S. P., and J. B. Krasinsky, *Density, Vapor Pressure, and Viscosity of Solutions of Hydrazine Mononitrate in Hydrazine*, Technical Memorandum No. 33-103, Jet Propulsion Laboratory, Pasadena, October 15, 1962.

II. PREPARATION OF SOLUTION AND TECHNIQUES USED TO OBTAIN DATA

The preparation of the solution, and the techniques used to measure vapor pressure, viscosity, and density, were the same as those reported in Technical Memorandum No. 33-103. The freezing point was not previously reported, and Fig. 1 shows the glass apparatus used to make this measurement.

The solution for making the freezing point measurement was freed of any slight traces of ammonia, as was described in connection with the vapor pressure measurement. The solution was placed into the apparatus via the 10/30 joint. It was then cooled in an acetone bath contained in a clear Dewar jar which was 20 to 30°C below the anticipated melting point. To facilitate heat transfer, air was admitted into the jacket via the 2-mm stopcock. The solution was stirred magnetically, and when some freezing had occurred, the air in the jacket was pumped out via the 2-mm stopcock. The apparatus was then placed into an acetone bath which was several degrees above the anticipated melting point. The warm-up was followed by means of a five-series, copper-constantan thermopile located in the well. For more effective heat transfer to the couples, enough kerosene was placed into the well to just cover the junctions. The reference junctions were kept at ice temperature. A plot was made of thermocouple voltage versus time, and the point of abrupt change was taken as the freezing point (i.e., the point at which the last crystal of ice disappeared).

III. CONCLUSION

Duplicate freezing point measurements gave a thermocouple EMF for the single copper-constantan couple of −0.561 mv and −0.558 mv, which is equivalent to −14.8°C.

The composition of the prepared solution and the freezing point are presented in Table 1.

The density values are presented in Fig. 2.

The vapor pressure values are presented in Fig. 3.

The viscosity values are presented in Fig. 4.

Table 1. Composition of prepared solution

74.49%	Hydrazine
24.19%	Hydrazine Mononitrate
0.99%	Water
0.33%	Aniline
Freezing point of solution	−14.8°C.[a]

[a] This is the temperature at which the last crystal of solid hydrazine disappears, and would also be the temperature at which the first crystal of solid hydrazine appears if supercooling did not occur.

Figures 5 through 10 give the density, vapor pressure, and viscosity data taken from Technical Memorandum No. 33-103.

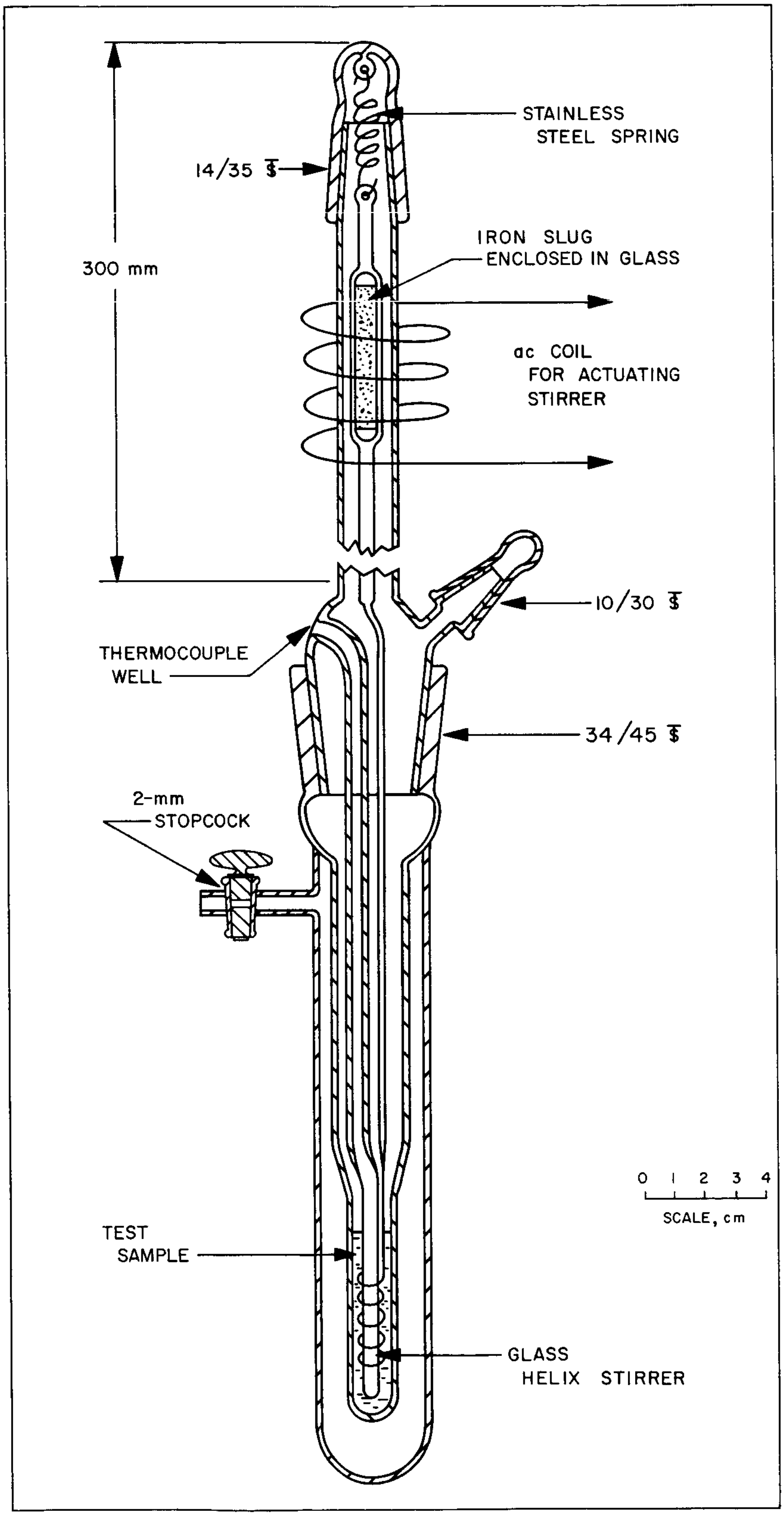

Fig. 1. Freezing point apparatus

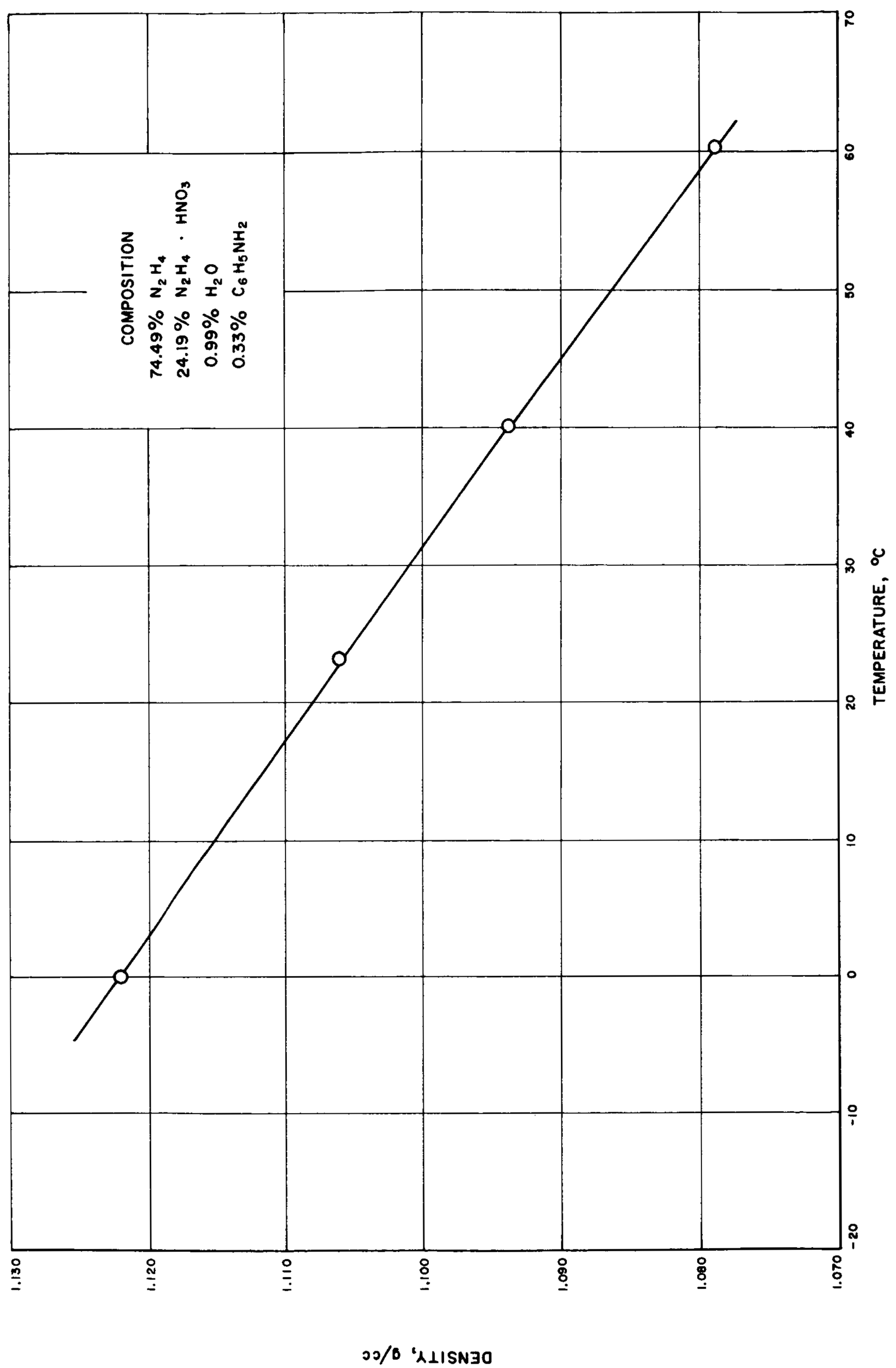

Fig. 2. Density vs. temperature

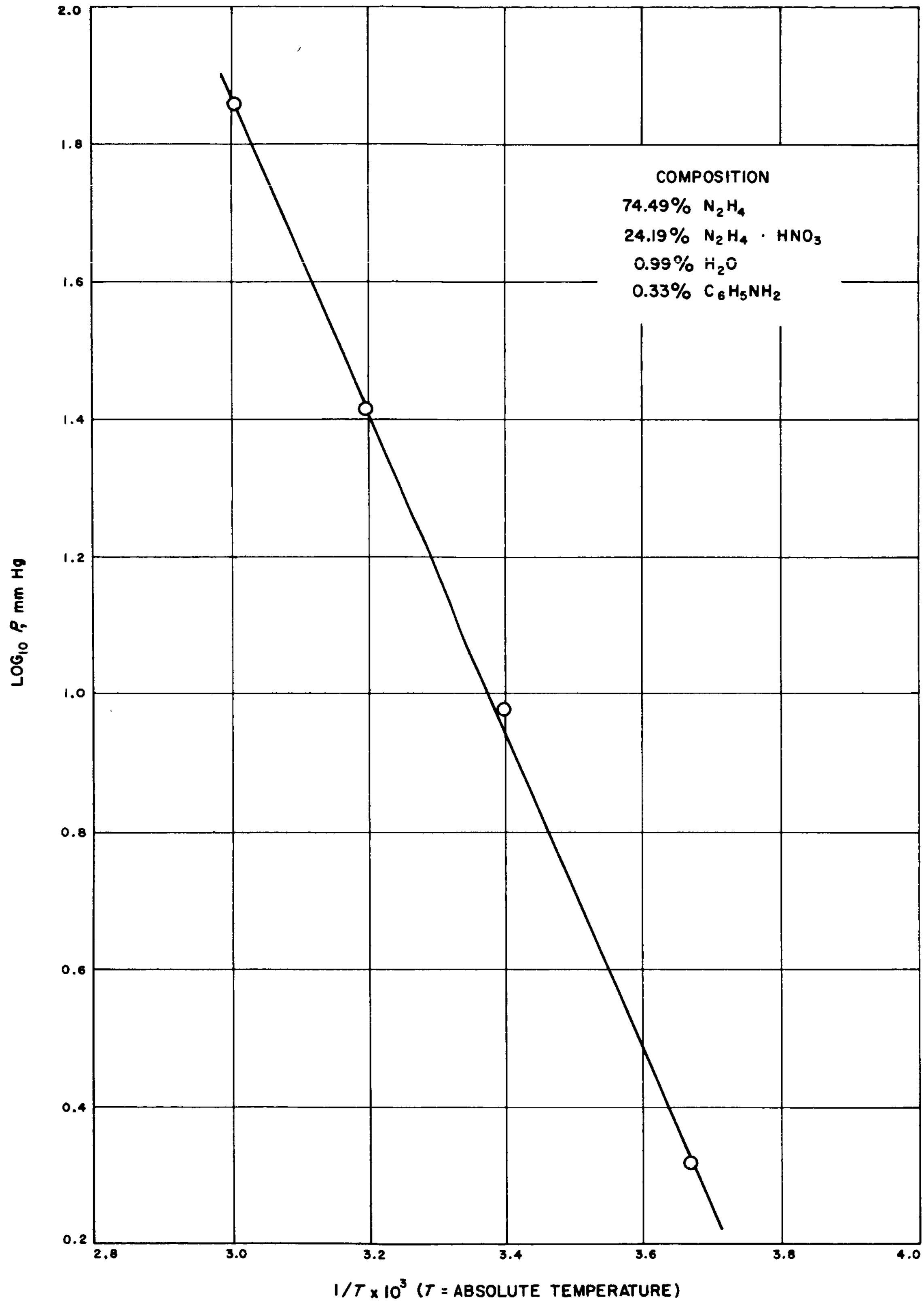

Fig. 3. Logarithm of vapor pressure vs. reciprocal of absolute temperature

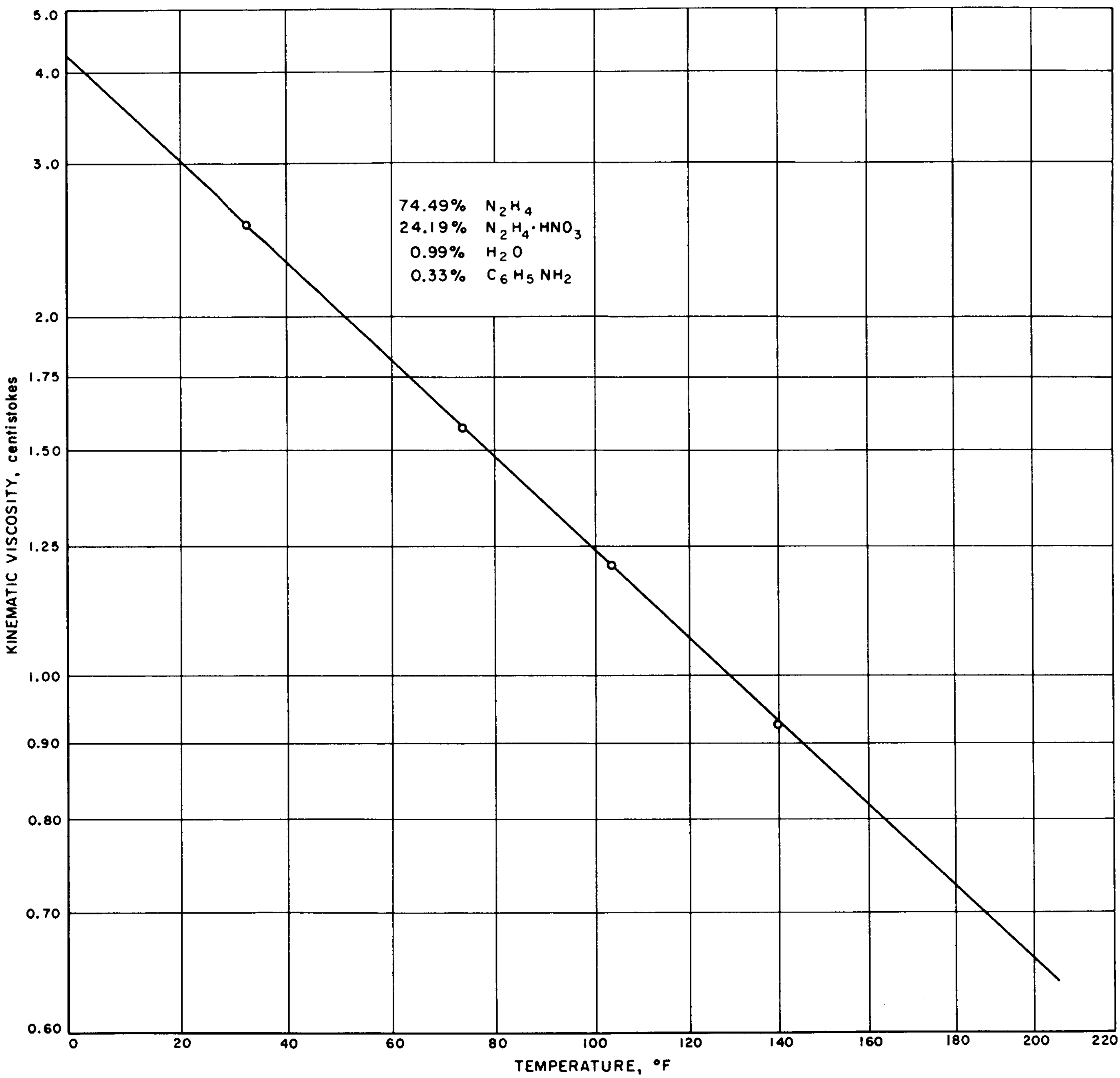

Fig. 4. Kinematic viscosity vs. temperature, °F

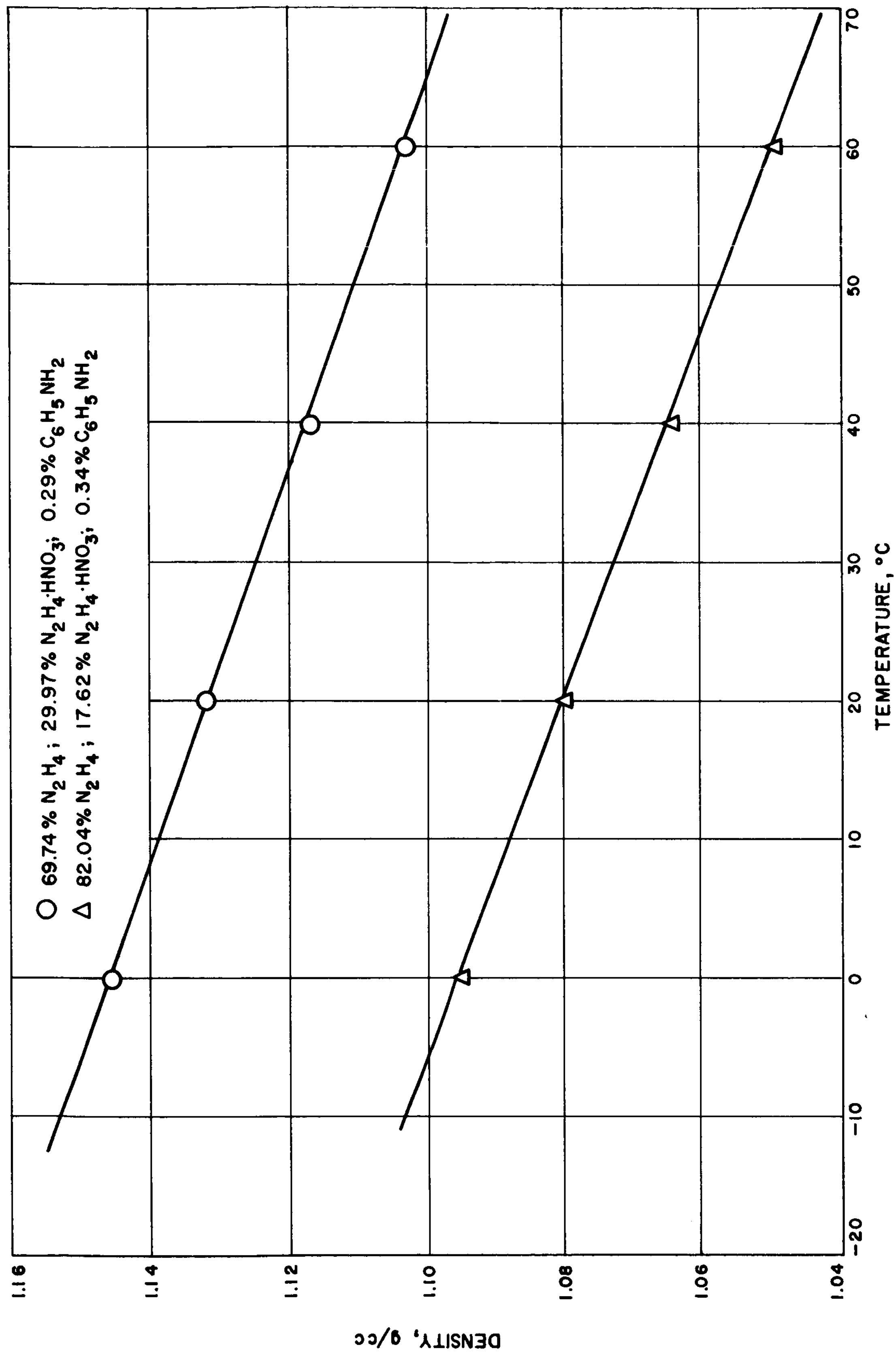

Fig. 5. Density vs. temperature, anhydrous solutions

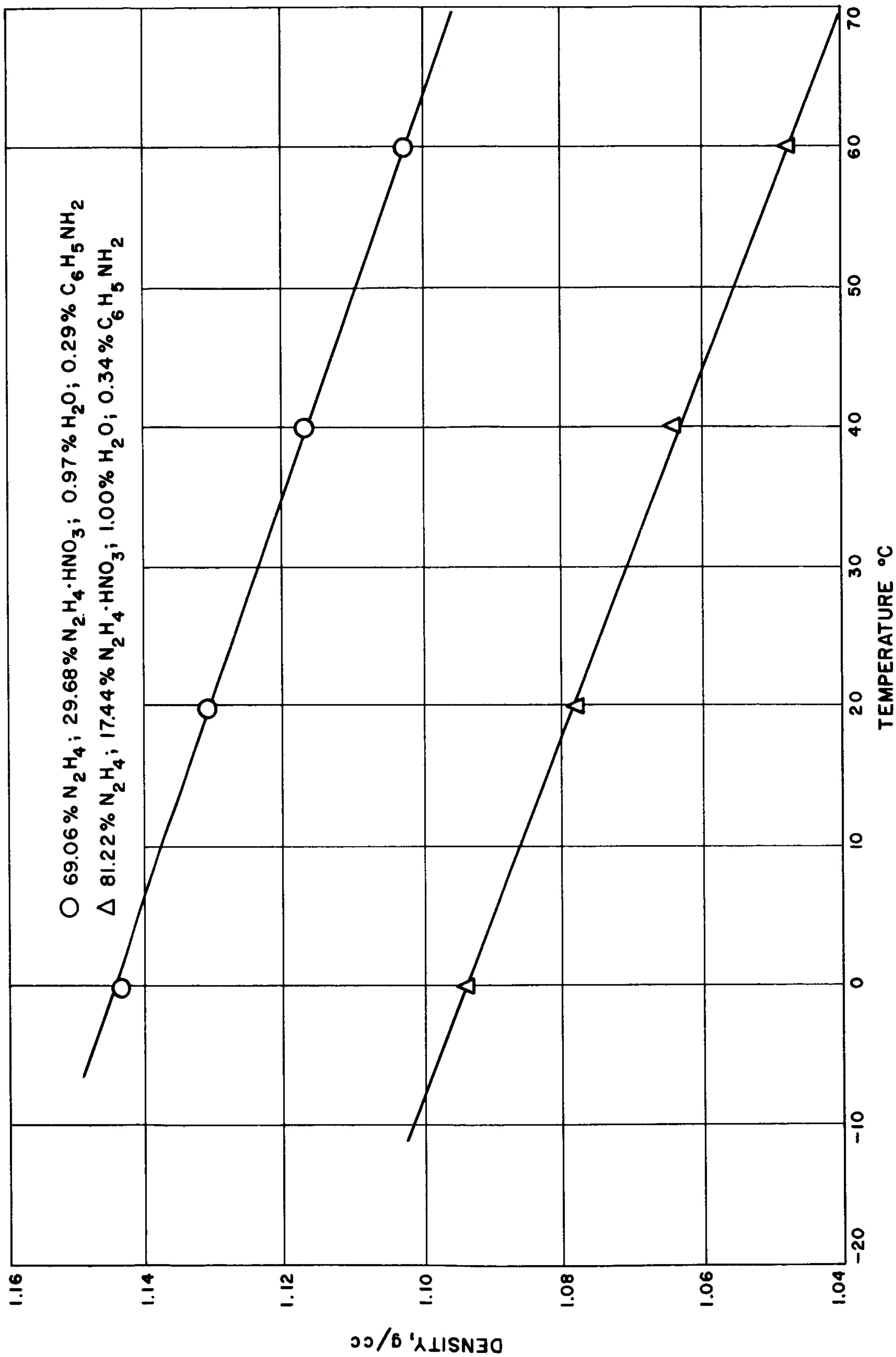

Fig. 6. Density vs. temperature, solutions containing 1 % water

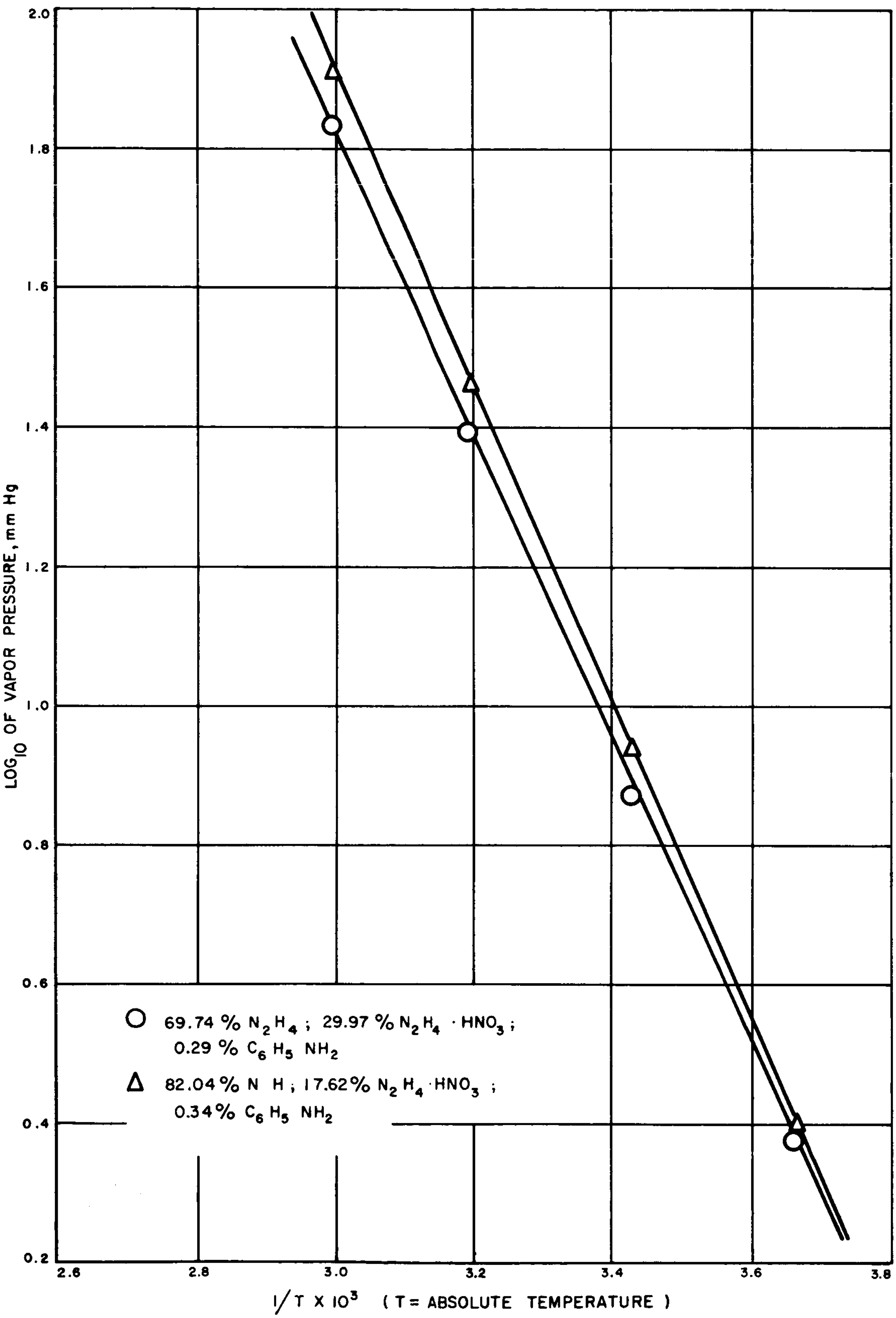

Fig. 7. Logarithm of vapor pressure vs. reciprocal of absolute temperature, anhydrous solutions

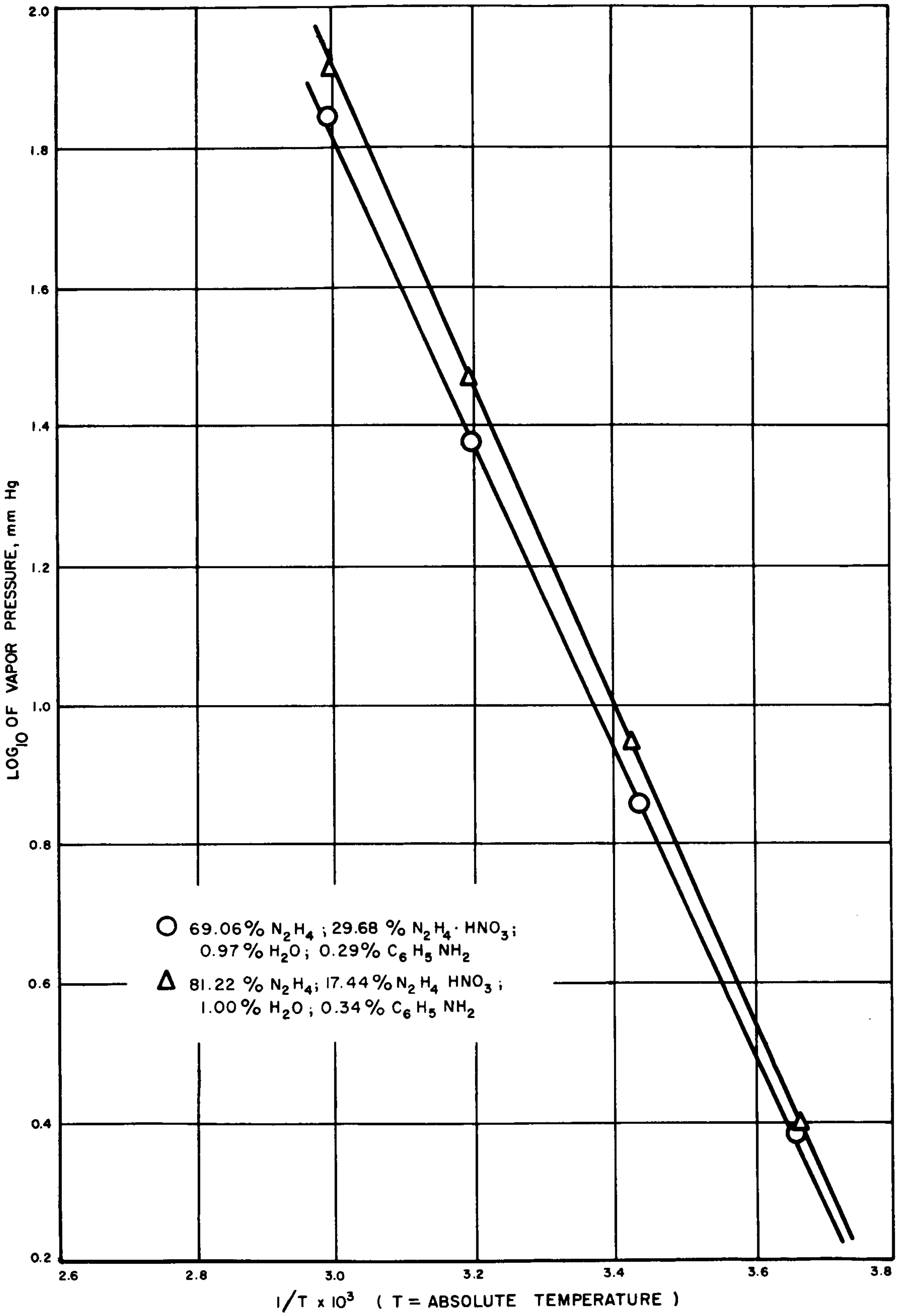

Fig. 8. Logarithm of vapor pressure vs. reciprocal of absolute temperature, solutions containing 1 % water

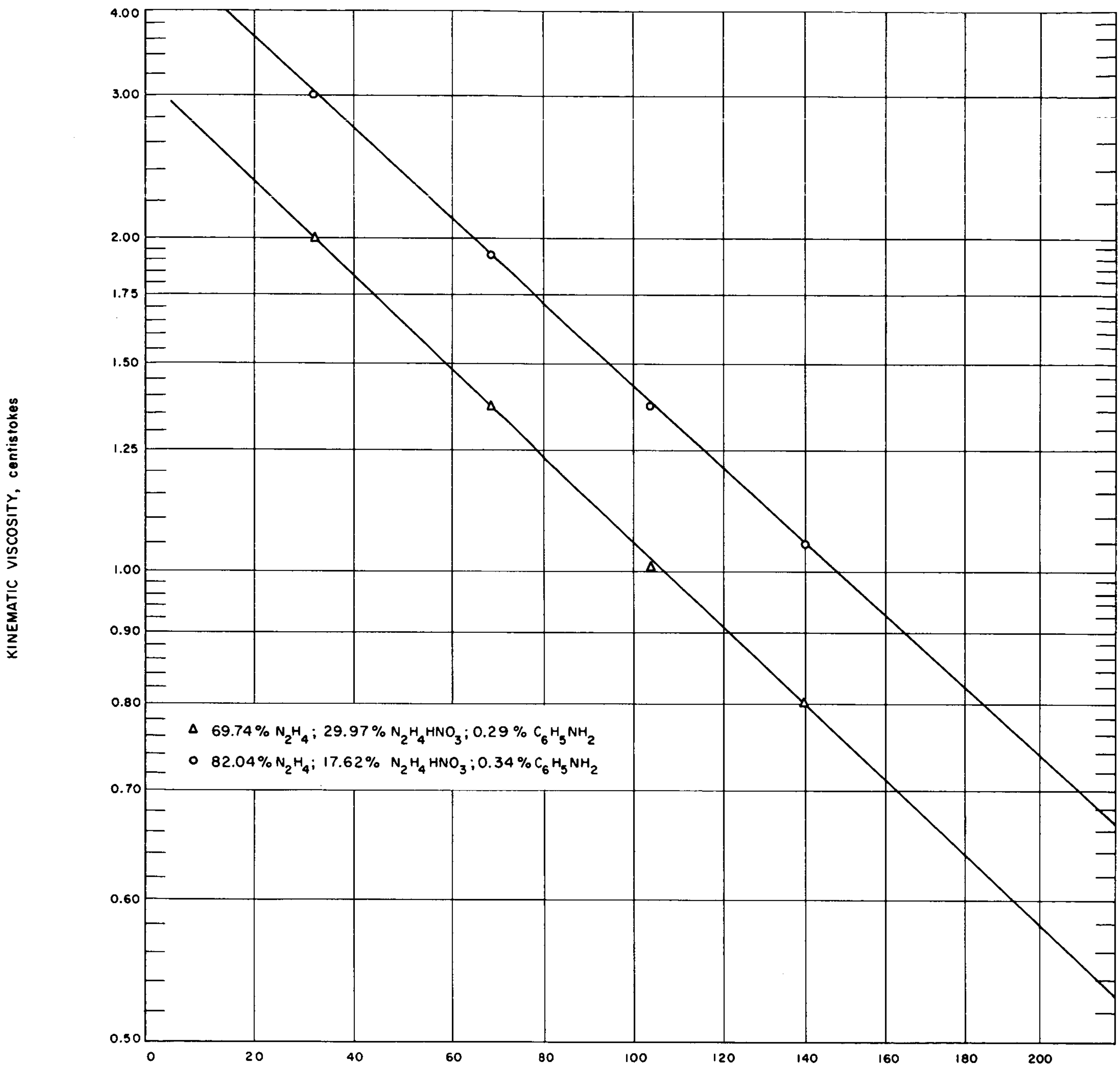

Fig. 9. Kinematic viscosity vs. temperature, °F, anhydrous solutions

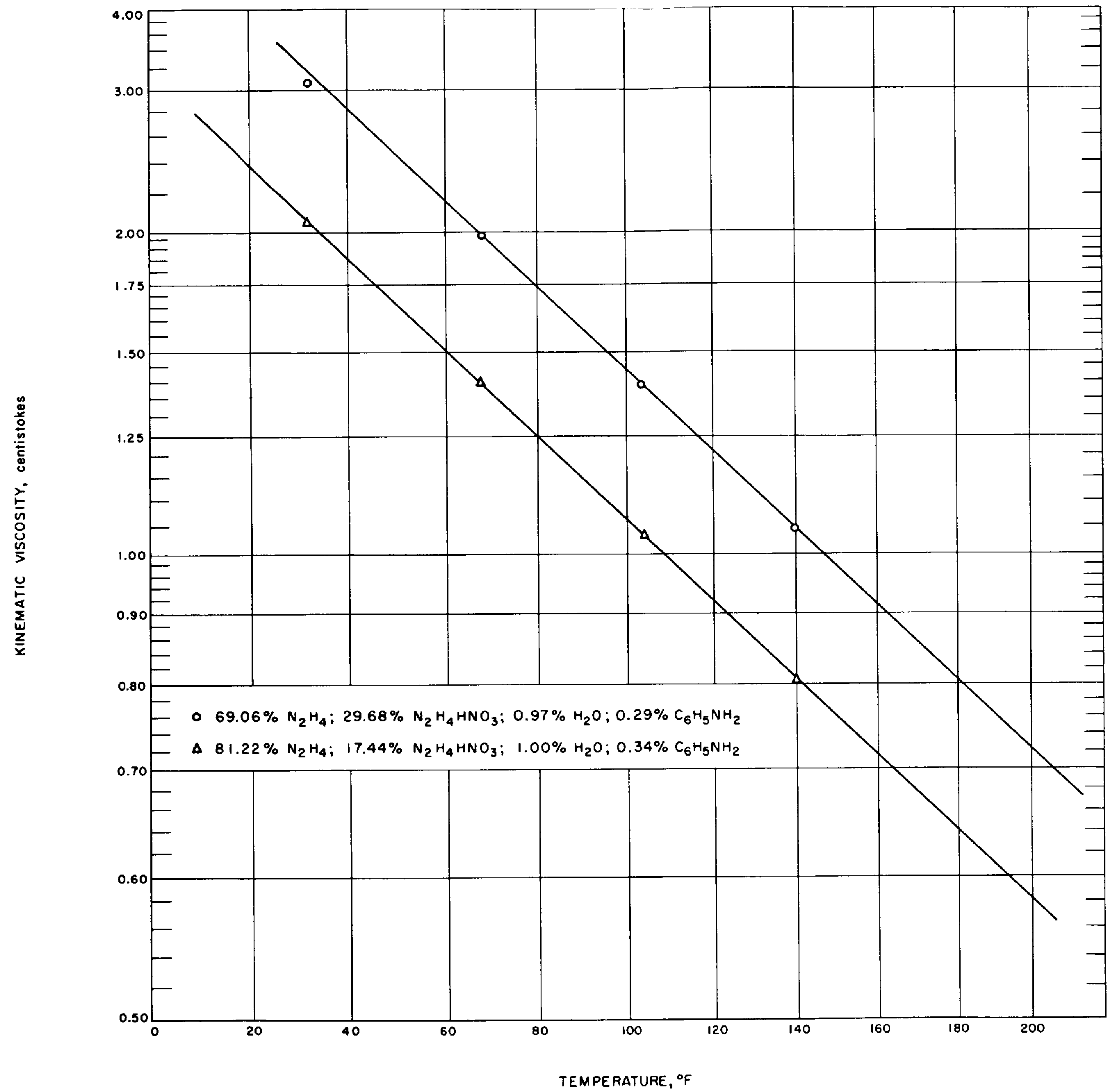

Fig. 10. Kinematic viscosity vs. temperature, °F, solutions containing 1% water